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WATER SUPPLY OUTLOOK FOR MONTANA

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JAN 10 1970

STANDARD SERIAL RECORDS

and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

UNITED STATES DEPARTMENT of AGRICULTURE--SOIL CONSERVATION SERVICE,
and
MONTANA AGRICULTURAL EXPERIMENT STATION

Data included in this report were obtained by the agencies named above in cooperation with Federal, State, and private organizations listed on the inside back cover of this report.

AS OF
JAN. 1, 1970

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts and appears as streamflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season will interact with a resultant average effect on runoff. Early season forecasts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth and water equivalent of surveyed and marked locations in mountain areas. A total of about ten samples are taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1400 snow courses in Western United States and in the Columbia Basin in British Columbia. In the near future, it is anticipated that automatic snow water equivalent sensing devices along with radio telemetry will provide a continuous record of snow water equivalent at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and local reports. Other data on reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulation to date, and storage in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic data summary and published about October 1 of each year.

PUBLISHED BY SOIL CONSERVATION SERVICE

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 209, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state and local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85025
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80202
Idaho	Room 345, 304 N. 8th. St., Boise, Idaho 83702
Montana	P. O. Box 98, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Portland, Oregon 97205
Utah	4012 Federal Building, Salt Lake City, Utah 84111
Washington	360 U.S. Court House, Spokane, Washington 99201
Wyoming	P. O. Box 340, Casper, Wyoming 82601

PUBLISHED BY OTHER AGENCIES.

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, California Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Forests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia



WATER SUPPLY OUTLOOK FOR MONTANA

and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

Issued by

KENNETH E. GRANT

ADMINISTRATOR
SOIL CONSERVATION SERVICE
WASHINGTON, D.C.

|||||

Released by

A. B. LINFORD

STATE CONSERVATIONIST
SOIL CONSERVATION SERVICE
Bozeman, Montana

In Cooperation with

J. A. ASLESON

DIRECTOR
Montana Agricultural Experiment Station

|||||

Report prepared by

P. E. FARNES, Snow Survey Supervisor

SOIL CONSERVATION SERVICE
P.O. Box 98
Bozeman, Montana 59715



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MONTANA WATER SUPPLY OUTLOOK

January 1, 1970

* * * * *

* The snowpack is below average over most of the State, but is near or above average in the lower Gallatin and in a portion of the Yellowstone and central Montana drainages.

* Moisture in the soils beneath the snowpack is generally below average, but is above average in the lower Gallatin drainage.

* * * * *

COLUMBIA RIVER DRAINAGE

Snow - January measurements were not made in the Kootenai River drainage; however, snowpack is expected to be 50 to 60 percent average, as it is in the Flathead and Clark Fork drainages. Most of the snowfall accumulated near the first of the year.

Soil moisture was below average throughout the summer and fall, and soils beneath the snowpack have below average moisture.

Streamflow - Since present measurements are near the beginning of the snow accumulation period, estimates of streamflow are not made until March 1.

THE HISTORY OF THE

REIGN OF

CHARLES THE FIRST

BY JOHN BURNET

IN TWO VOLUMES

THE SECOND VOLUME

1679

Printed by J. Streater

at the Sign of the Gun, in St. Dunstons Church-yard

near the North-Gate of London

1679

Printed by J. Streater

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MISSOURI RIVER DRAINAGE

Snow - Surveys made at a few snow courses indicate variable conditions. In the Judith, Musselshell, Smith and lower Gallatin drainages, heavy snowpack that occurred early in the season, combined with heavy snowfall near the first of the year resulted in well above average conditions. Elsewhere, snowpack is below average.

Soil moisture beneath the snowpack follows the pattern of January 1 surveys. Areas with above average snow have average or above average moisture. Soil moisture is deficient in low snowpack areas.

Streamflow - No forecasts of streamflow are made until March 1 when the status of the mountain snowpack becomes more definite.

YELLOWSTONE RIVER DRAINAGE

Snow - Snow cover at a few snow courses is near average in and near the drainage in Montana, but is below average in the southern portion of headwaters in Yellowstone National Park.

Soils beneath the snowpack contain less moisture than usual.

Streamflow - Streamflow forecasts will not be made until March 1.

THE HISTORY OF THE

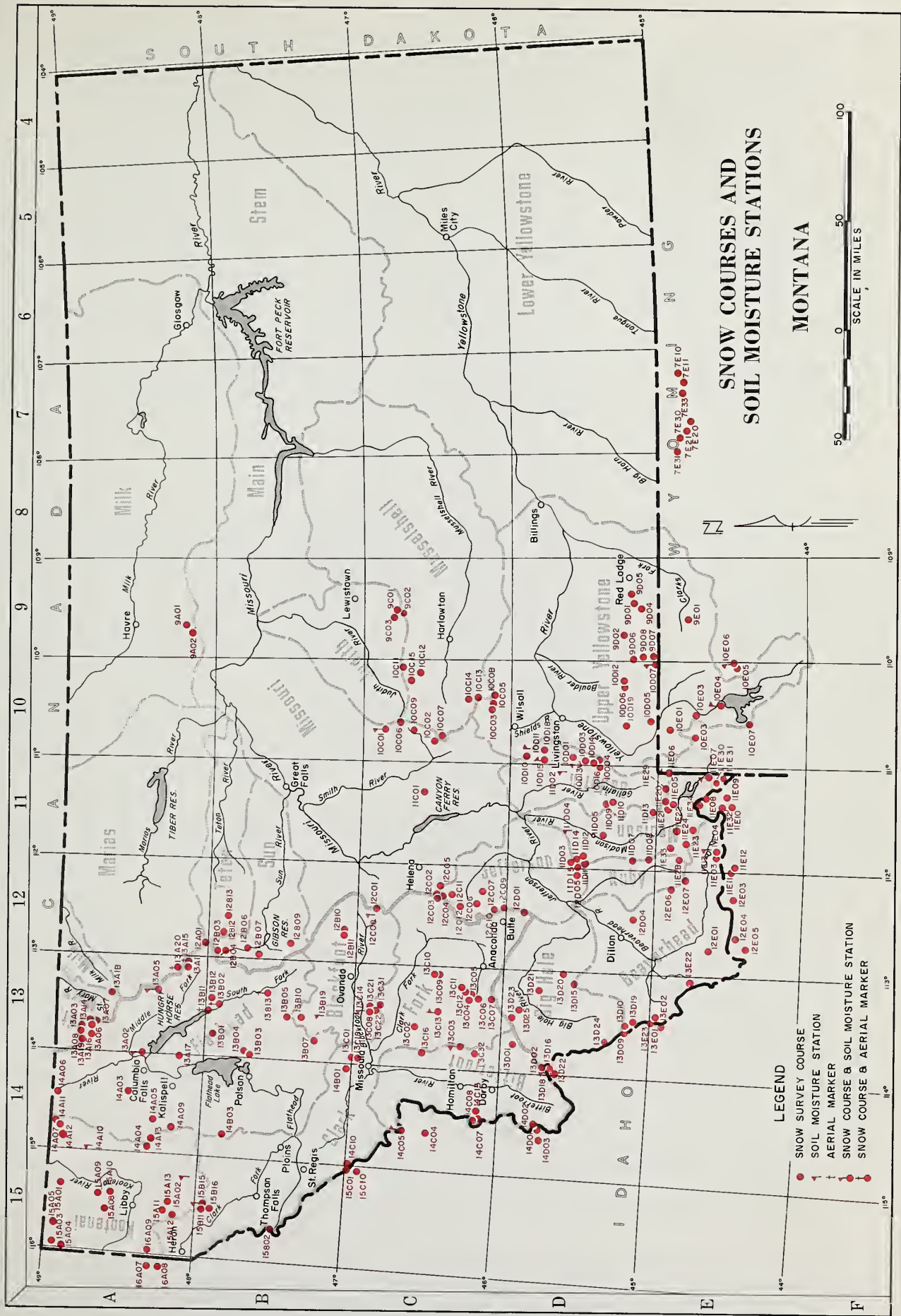
REIGN OF CHARLES THE FIRST
BY JOHN BURNET
OF THE UNIVERSITY OF OXFORD
IN TWO VOLUMES

LONDON: Printed by J. Streater, at the Sign of the Gun, in St. Dunstons Church-yard, 1679.

THE SECOND VOLUME.

IN TWO VOLUMES.

THE FIRST VOLUME.



INDEX to MONTANA SNOW COURSES and SOIL MOISTURE STATIONS

SNOW COURSES

COLUMBIA RIVER BASIN

[illegible]

MISSOURI RIVER BASIN

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2/ Minerals refer to Agency that makes the snow survey as follows:

1. U. S. Soil Conservation Service 7. MSU Agricultural

1. U. S. Geological Survey
2. U. S. Forest Service
3. U. S. Forest Service
4. U. S. Forest Service
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THE UNIVERSITY OF CHICAGO

SNOW

DRAINAGE BASIN and/or SNOW COURSE		THIS YEAR			PAST RECORD	
		Date of Survey	Snow Depth (Inches)	Water Content (Inches)	Water Content (inches)	
NAME	Elevation				Last Year	Average

COLUMBIA RIVER BASIN

FLATHEAD RIVER

Desert Mountain	5600	12/30	15	3.4	8.9	6.5
Hell Roaring Divide	5770	12/31	28	5.8	16.9	13.2*
Holbrook	4530	1/01	10	1.6A	8.0A	3.4
Marias Pass	5250	12/30	14	3.0	7.2	7.4
Spotted Bear Mountain	7000	1/01	22	4.2A	12.0A	6.5*
Twin Creeks	3580	1/01	18	3.2A	11.0A	5.0*

CLARK FORK RIVER

Black Pine	7100	12/30	16	2.8	5.6	3.9*
Black Pine Pillow	7100	12/30	SP	3.7	7.0	5.1*
Combination	5600	12/30	4	0.5	-	-
Coyote Hill	4200	1/02	14	2.6	5.4	4.3*
Heart Lake Trail	4800	12/29	24	4.9	12.4	-
Hoodoo Basin	6000	12/29	53	12.9	28.1	-
Hoodoo Basin Pillow	6000	12/31	SP	11.5	-	-
Hoodoo Creek	5900	12/29	46	10.2	26.0	18.0*
Lookout	5250	12/31	36	9.0	18.8	15.7
Lubrecht Forest No. 3	5450	No Measurement			3.4	2.6*
Lubrecht Forest No. 4	4650	No Measurement			2.0	1.4*
Lubrecht Forest No. 6	4040	No Measurement			2.1	1.6*
Storm Lake	7780	12/29	29	5.4	5.8	5.5*
Stuart Mountain	7400	No Measurement			15.1	12.1*
TV Mountain	6800	No Measurement			7.2	6.6*

BITTERROOT RIVER

Gibbons Pass	7100	1/02	28	5.6	10.4	9.6
Lolo Pass	5230	12/30	35	6.8	12.8	-
Lost Horse	5940	12/30	34	7.2	14.8	-
Moose Creek	6200	12/31	22	3.7	5.8	-
Saddle Mountain	7940	1/02	33	7.1	11.7	-
Saddle Mountain Pillow	7900	1/02	SP	7.8	14.1	-
Twelvemile Creek	5600	12/30	25	4.4	9.1	-
Twelvemile Creek Pillow	5600	12/30	SP	3.8	7.6	-
Twin Lakes	6510	12/30	42	9.5	19.6	-
Twin Lakes Pillow	6400	12/30	SP	9.1	20.6	-

A - Aerial observation - water content estimated.

SP - Snow pillow observation - water content only.



SNOW

DRAINAGE BASIN and/or SNOW COURSE		THIS YEAR			PAST RECORD	
		Date of Survey	Snow Depth (Inches)	Water Content (Inches)	Water Content (inches)	
NAME	Elevation				Last Year	Average

MISSOURI RIVER BASIN

BEAVERHEAD RIVER

Camp Creek	6800	12/31	16	3.3	5.1	3.5
Kilgore	6200	12/28	19	4.0	6.2	3.5*
Lakeview Canyon	6930	12/30	13	3.4	4.6	4.6*
Lakeview Ridge	7400	12/30	13	3.2	4.4	4.2*
Sawtelle Mountain	8715	12/30	48	11.9	15.0	-

JEFFERSON RIVER

Pipestone Pass	7200	12/29	7	1.3	3.1	2.2*
Rocker Peak	8000	1/02	30	5.7	6.2	-
Rocker Peak Pillow	8000	1/02	SP	6.5	6.7	-
Uncle Sam Gulch	6500	1/02	13	1.9	4.1	-

MADISON RIVER

Big Springs	6500	12/30	31	5.4	8.4	7.2
Hebgen Dam	6550	12/30	20	3.0	5.2	4.5
Island Park	6315	12/30	27	4.6	6.4	5.6
Lake Creek	6100	12/31	17	2.6	-	-
Lion Mountain	8760	12/30	38	8.5	-	-
Meridian Creek	7000	12/31	19	2.6	-	-
Norris Basin	7500	No Measurement			-	4.3*
Soap Bogus Divide	7600	1/02	33	5.5	-	-
Tepee Creek	8000	12/31	29	6.2	-	-
Valley View	6500	12/30	23	3.2	6.3	5.3
West Yellowstone	6700	12/30	18	3.7	5.9	4.3
West Yellowstone Pillow	6700	12/28	SP	2.4	4.9	-

SP - Snow pillow observation - water content only.

* - Adjusted average.



SNOW

DRAINAGE BASIN and/or SNOW COURSE		THIS YEAR			PAST RECORD	
		Date of Survey	Snow Depth (Inches)	Water Content (Inches)	Water Content (inches)	
NAME	Elevation				Last Year	Average

GALLATIN RIVER

Arch Falls	7350	12/30	33	7.6	5.7	4.3*
Bridger Bowl	7250	12/29	58	14.7	11.8	9.4*
Bridger Bowl Pillow	7250	12/29	SP	14.0	11.9	9.3*
Devils Slide	8100	12/30	53	13.0	10.0	8.6*
Hood Meadow	6600	12/30	32	7.4	4.0	-
Hood Meadow (New)	6600	12/30	36	8.2	4.6	-
Lick Creek	6860	12/30	34	6.2	3.7	3.3*
Lick Creek Pillow	6860	12/30	SP	5.9	2.9	3.3*
Maynard Creek	6210	12/29	34	7.9	6.9	-
Maynard Creek Pillow	6210	12/29	SP	5.7	5.1	-
Shower Falls	8100	12/30	60	14.7	12.0	10.2*
Shower Falls Pillow	8100	12/30	SP	13.0	10.6	9.5*
Twenty-One Mile	7150	12/31	23	4.6	9.2	7.2

MISSOURI RIVER (Main Stem)

Chessman Reservoir	6200	12/30	0	0.0	2.4	1.4
Ten Mile Lower	6600	12/30	9	0.6	4.3	2.8
Ten Mile Middle	6800	12/29	16	1.9	5.5	4.3
Ten Mile Upper	8000	12/29	21	3.3	6.9	5.5

SUN-TETON-MARIAS RIVERS

Badger Pass	6900	1/01	85	19.0A	32.0A	-
Blue Lake	5900	1/01	32	6.7A	22.0A	-

UPPER YELLOWSTONE

Canyon	7750	No Measurement			5.7	6.0
Grizzly Peak	8400	12/30	37	8.4	5.8	7.2*
Lake Camp	7850	12/30	13	1.5	3.8	3.5
Lupine	7300	No Measurement			-	4.2*
Northeast Entrance	7400	12/30	18	3.1	4.5	3.5
Northeast Entrance Pillow	7400	12/31	SP	4.1	5.0	-
Sylvan Pass	7100	1/02	21	3.5	5.9	5.5*
Thumb Divide	7900	1/02	26	4.9	-	8.8*

A - Aerial observation - water content only.

SP - Snow pillow observation - water content only.

* - Adjusted average.



SOIL MOISTURE MEASUREMENTS

NOVEMBER 1, 1969

STATION	Profile (Inches)		Soil Moisture (Inches)		
	Depth	Capacity	Date	This Year	Average †

COLUMBIA RIVER BASINKootenai

Baree Trail	48	7.5	11/12	5.5	5.9
Murphy Lake R.S.	48	22.6			18.9
Raven R.S.	48	23.0	11/12	15.6	18.6

Flathead

Desert Mountain	54	8.4		-	6.7
Marias Pass	54	6.5		-	4.6

Clark Fork

Black Pine	48	10.0	10/30	7.6	8.0
Seeley Lake R.S.	48	11.9	11/10	4.5	4.7
Skalkaho Summit	48	10.8	10/30	10.1	-

Bitterroot

Gibbons Pass	48	7.1	10/30	3.9	5.7
Lolo Pass	48	10.6	10/29	4.5	6.3

MISSOURI RIVER BASINBeaverhead

Lakeview	48	15.3	11/01	5.5	5.9
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Madison

West Yellowstone	48	6.5	10/28	1.8	-
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Gallatin

Bridger Bowl	48	17.0		-	-
College Site	54	14.5	10/31	14.8	8.1
Lick Creek	48	18.8	10/27	18.4	-
Twenty-One Mile	48	10.0	10/28	2.9	4.6

Missouri Main Stem

Kings Hill	48	11.8	10/31	5.9	8.0
Stemple Pass	48	5.9	10/30	3.9	4.1

Milk

Beaver Creek	48	20.9	10/31	8.9	-
Rocky Boy	36	10.1	10/31	9.4	-

Yellowstone

Battle Ridge	48	17.6		-	11.6
Northeast Entrance	48	9.4	10/28	5.0	7.2



SOIL MOISTURE MEASUREMENTS

DECEMBER 1, 1969

STATION	Profile (Inches)		Soil Moisture (Inches)		
	Depth	Capacity	Date	This Year	Average †

COLUMBIA RIVER BASINKootenai

Baree Trail	48	7.5	12/03	5.4	6.7
Murphy Lake R.S.	48	22.6	11/20	19.3	19.4
Raven R.S.	48	23.0	12/03	16.5	20.4

Flathead

Desert Mountain	54	8.4		-	-
Marias Pass	54	6.5	11/30	4.5	4.8

Clark Fork

Black Pine	48	10.0	12/01	7.3	8.5
Seeley Lake R.S.	48	11.9	12/01	4.3	5.5
Skalkaho Summit	48	10.8	12/01	9.8	-

Bitterroot

Gibbons Pass	48	7.1	11/26	3.2	5.6
Lolo Pass	48	10.6	12/01	4.9	6.3

MISSOURI RIVER BASINBeaverhead

Lakeview	48	15.3	12/01	5.4	7.1
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Madison

West Yellowstone	48	6.5	11/28	1.6	-
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Gallatin

Bridger Bowl	48	17.0	12/01	16.6	-
College Site	54	14.5	11/28	14.9	9.7
Lick Creek	48	18.8	12/02	17.2	-
Twenty-One Mile	48	10.0	11/28	2.7	3.7

Missouri Main Stem

Kings Hill	48	11.8	11/28	6.7	7.9
Stemple Pass	48	5.9	12/01	3.6	4.2

Milk

Beaver Creek	48	20.9	12/02	8.7	-
Rocky Boy	36	10.1	12/02	8.5	-

Yellowstone

Battle Ridge	48	17.6	12/01	13.1	12.6
Northeast Entrance	48	9.4	12/01	4.9	7.2



SOIL MOISTURE MEASUREMENTS

JANUARY 1, 1970

STATION	Profile (Inches)		Soil Moisture (Inches)		
	Depth	Capacity	Date	This Year	Average †

COLUMBIA RIVER BASINKootenai

Baree Trail	48	7.5	-	-	-
Murphy Lake R.S.	48	22.6	1/07	19.2	19.6
Raven R.S.	48	23.0	Delayed		20.5

Flathead

Desert Mountain	54	8.4	12/30	6.6	7.0
Marias Pass	54	6.5	12/29	4.6	4.8

Clark Fork

Black Pine	48	10.0	12/30	7.0	7.4
Seeley Lake R.S.	48	11.9	1/02	4.1	6.4
Skalkaho Summit	48	10.8	-	-	-

Bitterroot

Gibbons Pass	48	7.1	1/02	3.1	5.4
Lolo Pass	48	10.6	Delayed		6.7

MISSOURI RIVER BASINBeaverhead

Lakeview	48	15.3	12/30	5.4	7.2
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Madison

West Yellowstone	48	6.5	Delayed		-
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Gallatin

Bridger Bowl	48	17.0	12/29	16.5	-
College Site	54	14.5	1/02	14.8	9.6
Lick Creek	48	18.8	-	-	-
Twenty-One Mile	48	10.0	Delayed		3.5

Missouri Main Stem

Kings Hill	48	11.8	Delayed		7.3
Stemple Pass	48	5.9	12/30	3.4	4.1

Milk

Beaver Creek	48	20.9	Delayed		-
Rocky Boy	36	10.1	Delayed		-

Yellowstone

Battle Ridge	48	17.6	12/29	12.2	12.4
Northeast Entrance	48	9.4	12/31	4.0	6.9

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RESERVOIR STORAGE (Thousand Acre Feet) END OF MONTH

Basin or Stream	RESERVOIR	Usable Capacity	Usable Storage		
			This Year	Last Year	Average
<u>COLUMBIA RIVER BASIN</u>					
Flathead	Hungry Horse	3,428.0	2,012.0	3,147.0	2,766.0
	Flathead Lake	1,791.0	1,336.0	1,402.0	1,330.0
	Camas (Sum of 4)	45.2	17.6	12.6	26.7
	Mission Valley (Sum of 8)	100.3	21.7	82.8	28.7
Clark Fork	Georgetown Lake	31.0	28.6	30.0	26.2
	Noxon Rapids	334.6	325.6	314.1	321.1
Bitterroot	Como	34.9	4.3	14.2	6.9
	Painted Rocks	31.7	23.1	29.5	23.2

MISSOURI RIVER BASIN

Beaverhead	Clark Canyon	328.9	141.0	151.3	122.4
	Lima	84.0	40.3	45.5	22.6
Ruby	Ruby	38.8	23.8	27.2	18.6
Madison	Hebgen Lake	377.5	266.4	299.5	170.6
	Ennis Lake	41.0	35.0	35.0	37.5
Gallatin	Middle Creek	8.0	3.4	3.0	2.9
Missouri	Canyon Ferry	2,043.0	1,779.0	1,751.0	1,676.0
	Hauser & Helena	61.9	61.9	73.2	58.2
	Lake Helena	10.4	10.4	10.7	9.2
	Holter Lake	81.9	78.8	64.9	70.5
	Smith River	10.7	4.4	7.5	5.6
	Durand	7.0	2.8	6.0	3.8
	Martinsdale	23.1	4.8	10.6	6.8
	Deadman's Basin	72.2	28.3	47.1	39.1
	Fort Peck	19,410.0	16,660.0	16,480.0	11,080.0
	Gibson	105.0	15.5	59.5	44.1
Sun	Willow Creek	32.3	17.7	20.4	20.2
	Pishkun	32.0	17.5	17.2	18.1
	Lower Two Medicine	16.6	5.1	0	0
Marias	Four Horns	19.2	12.8	-	12.3
	Swift	30.0	13.4	18.5	15.6
	Lake Frances	112.0	82.7	79.0	83.5
	Tiber	1,347.0	557.3	452.0	625.4
Milk	Fresno	127.2	73.5	90.3	61.9
	Nelson	66.8	49.4	46.7	44.4
	Lake Sherburne	66.1	14.0	20.8	15.3
Yellowstone	Mystic Lake	20.8	11.8	15.2	13.5
	Tongue River	68.0	29.6	30.4	18.8
	Cooney	27.5	12.5	18.8	12.5
Big Horn	Yellowtail	1,356.0	790.8	786.6	626.2



Agencies and Organizations Cooperating in Montana Snow Surveys

U. S. Forest Service
Region I, Missoula, Montana
Montana Forests and Ranger
Districts

U. S. Geological Survey
Helena, Montana
Portland, Oregon

U. S. Army Corps of Engineers
Portland, Oregon
Seattle, Washington
Walla Walla, Washington
Omaha, Nebraska

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St. Ignatius, Montana

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Helena, Montana
Portland, Oregon
Kansas City, Missouri

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and Wildlife
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Boise, Idaho

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Portland, Oregon

U. S. Soil Conservation Service
Montana, Wyoming, Idaho

Soil and Water Conservation Districts
Montana Counties

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Glacier National Park

Montana Power Company
Butte, Montana

Montana Water Resources Board
Helena, Montana

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Agricultural Experiment Station
Havre, Montana

Montana State University
Agricultural Experiment Station
Bozeman, Montana

University of Montana
School of Forestry
Missoula, Montana

Water Rights Branch, Dept. of
Lands and Forests
Victoria, British Columbia

Department of Energy, Mines and
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